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| 09/785,282 | 02/20/2001 | Raymond Duchesne | DIGI8 | 4216 |

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EXAMINER

PUENTE, EMERSON C

| ART UNIT | PAPER NUMBER |
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2113

DATE MAILED: 03/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/785,282

Applicant(s)

DUCHESNE ET AL.

Examiner

Emerson C Puente

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 December 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) _____ is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 9 and 10 is/are allowed.
- 6) ☒ Claim(s) 1-8 and 11-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

This action is made **FINAL**.

Claims 1-14 have been examined.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-8 are rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 5,928,367 of Nelson et al. referred hereinafter "Nelson" in further view of US Patent No. 4,141,066 of Keiles and US Patent No. 6,073,218 of DeKoning et al. referred hereinafter "DeKoning".

In regards to claim 1, Nelson discloses a system able to function with undiminished capacity despite the failure of any storage array controller comprising:

active storage array controller (see column 9 lines 20-25).

each active storage array controller capable of periodically generating a signal termed a heartbeat when the storage array controller is operational (see column 9 lines 30-35).

array of storage units, each active storage array controller connected by at least one connector to one array of storage units (see figures 1,2 item 12, 15 and column 2 lines 40-45).

each active storage array controller controlling one or more arrays of storage units (see column 2 lines 40-47), and

one only passive storage array controller (see column 9 lines 20-25).

the passive storage array controller capable of activation on the cessation of a heartbeat generated by one of the active storage array controllers (see column 9 lines 42-52).

the passive storage array controller connected by at least one connector to each active storage array controller (see figures 2 and column 2 lines 40-45),

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the passive storage array controller able to control any one of the arrays of storage devices in the case of failure of an active storage array controller (see column 9 lines 45-50).

Nelson does not explicitly teach n active storage array controllers, when n is from 2 to 20, nor n array of storage units. Nelson does teach, however, providing reliable failover in the event of a failure (see column 1 lines 50-55).

Keiles discloses a backup (passive) controller for three primary (active) controllers, indicating n active storage array controllers, when n is from 2 to 20 (see figure 1 and column 3 lines 23-28 and 55-60).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Nelson with those of Keiles. One of ordinary skill in the art at the time of the invention would have been motivated to combine the teachings because Keiles teachings provides improved reliability in the event of a failure of one of the controllers (see column 1 lines 20-30), a need expressed in Nelson (see column 1 lines 50-55).

It is also understood that the combination of Nelson and Keiles that would result in n arrays of storage units because Nelson discloses an array of storage units for the master (active) controller and thus there would be n array of storage units for n master (active) controllers.

Furthermore, Nelson does not explicitly teach a RAID system. Nelson, however, discloses a disk storage system (see column 1 lines 50-55).

DeKoning teaches a RAID system (see column 1 lines 39-63).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have a RAID system. One of ordinary skill in the art at the time of the invention would have been motivated because Nelson discloses a disk storage system and a RAID system constitutes a disk storage system, as per teaching of DeKoning (see column 1 lines 39-63).

In regards to claim 2, Nelson discloses a RAID system able to function with undiminished capacity despite the failure of a storage array controller comprising:

active storage array controller (see column 9 lines 20-25),

each active storage array controller capable of periodically generating a signal termed a heartbeat when the storage array controller is operational (see column 9 lines 30-35).

array of storage units, each active storage array controller connected by at least one connector to and controlling one or more arrays of storage units (see figure 1,2 item 12, 15 and column 2 lines 40-47).

one passive storage array controller (see column 9 lines 20-25).

the passive storage array controller capable of activation on the cessation of a heartbeat generated by one of the active storage array controllers (see column 9 lines 42-52).

each active storage array controller connected by at least one connector to the passive storage array controller (see figure 2 and column 2 lines 40-45), and

the passive storage array controller able to assume the identity of a failed active storage array controller and to control the at least one array of storage units controlled by the failed active storage array controller (see column 9 lines 45-50).

Nelson does not explicitly teach three active storage array controllers, nor three arrays of storage units. Nelson does teach, however, providing reliable failover in the event of a failure (see column 1 lines 50-55).

Keiles discloses a backup (passive) controller for three primary (active) controllers, indicating three active storage array controllers (see figure 1 and column 3 lines 23-28 and 55-60).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Nelson with those of Keiles. One of ordinary skill in the art at the time of the invention would have been motivated to combine the teachings because Keiles teachings provides improved reliability in the event of a failure of one of the controllers (see column 1 lines 20-30), a need expressed in Nelson (see column 1 lines 50-55).

It is also understood that the combination of Nelson and Keiles that would result in three arrays of storage units because Nelson discloses an array of storage units for the master (active) controller and thus there would be three arrays of storage units for three master (active) controllers.

Furthermore, Nelson does not explicitly teach a RAID system and wherein each array of storage units comprising a multiplicity of storage units and at least one connector between each storage unit and the active storage array controller which controls that array, each array comprised of a multiplicity of active storage array units and one or more parity storage units

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Nelson, however, discloses a disk storage system (see column 1 lines 50-55).

DeKoning teaches a RAID system, wherein each array of storage units comprising a multiplicity of storage units and at least one connector between each storage unit and the active storage array controller which controls that array, each array comprised of a multiplicity of active storage array units and one or more parity storage units (see column 1 lines 39-63).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have a RAID system, wherein each array of storage units comprising a multiplicity of storage units and at least one connector between each storage unit and the active storage array controller which controls that array, each array comprised of a multiplicity of active storage array units and one or more parity storage units. One of ordinary skill in the art at the time of the invention would have been motivated because Nelson discloses a disk storage system and a RAID system constitutes a disk storage system, as per teaching of DeKoning (see column 1 lines 39-63).

In regards to claim 3 and 5, Nelson does not explicitly teach two connectors connect each storage unit with one storage array controller. Nelson does teach, however, providing reliable failover in the event of a failure (see column 1 lines 50-55).

DeKoning discloses wherein two connectors connect each storage unit with one storage array controller (see figure 11 items 150.1, 150.2 and column 22 lines 50-60).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Nelson with those of DeKoning. One of ordinary skill in the art at the time of the invention would have been motivated because DeKoning teaches that having two connectors connecting each storage unit with one storage array controller provides enhanced redundancy (see column 22 lines 55-60), thus improving reliability, a need expressed in Nelson (see column 1 lines 50-55).

In regards to claim 4 and 6, Nelson does not explicitly teach one connector connects each storage unit with each of greater than one storage array controller. Nelson does teach, however, providing reliable failover in the event of a failure (see column 1 lines 50-55).

DeKoning discloses wherein one connector connects each storage unit with each of greater than one storage array controller (see figure 11 item 150.1 or 150.2 and column 22 lines 50-60).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Nelson with those of DeKoning. One of ordinary skill in the art at the time of the invention would have been motivated because DeKoning teaches that having one connector connecting each storage unit with each of greater than one storage array controller provides enhanced redundancy (see column 22 lines 55-60), thus improving reliability, a need expressed in Nelson (see column 1 lines 50-55).

In regards to claim 7 and 8, Nelson does not explicitly each wherein each active storage array controller is connected by at least one connector to two adjacent active controller, forming a ring of active storage array controllers. Nelson does teach, however, providing reliable failover in the event of a failure (see column 1 lines 50-55).

DeKoning teaches wherein each active storage array controller is connected by at least one connector to two adjacent active controller, forming a ring of active storage array controllers (see figure 11 and column 22 lines 50-67 and column 23 lines 1-21).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Nelson with those of DeKoning. One of ordinary skill in the art at the time of the invention would have been motivated because DeKoning teaches that each active storage array controller is connected by at least one connector to two adjacent active controller, forming a ring of active storage array controllers, provides enhanced redundancy (see column 22 lines 55-60), thus improving reliability, a need expressed in Nelson (see column 1 lines 50-55).

Claims 11-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over in further view of US Patent No. 6,343,324 of Hubis et al. referred hereinafter "Hubis".

In regards to claim 11, Nelson discloses maintaining the channel capacity of a storage system having storage array controllers which control direct access storage devices (DASD) and which generate signals termed heartbeats when the storage array controllers are operational when an active storage array controller fails comprising the steps of:

ceasing the emission of the heartbeat by a defective active storage array controller (see column 9 lines 30-35);

detecting the cessation of the heartbeat by a defective active storage array controller by a passive storage array controller (see column 9 lines 30-35);

assuming the identity of the defective active storage controller by the passive storage array controller (see column 9 lines 45-50);

It is inherent identifying the DASD of the defective storage array controller by the passive array controller and assuming control of the DASD of the defective storage array controller by the passive storage array controller. Nelson discloses a storage management system comprising of storage devices and disk array (DASD), indicating the master or primary controller controls the DASD. Since the slave or passive controller assumes the identity of the master or primary control during the cessation of a heartbeat signal (see figure 5 item 12 and 15 and column 10 lines 35-45), it therefore must be able identify the DASD of the defective storage array controller by the passive array controller and assuming control of the DASD of the defective storage array controller by the passive storage array controller.

However, Nelson fails to disclose:

a RAID system

a table on each DASD used to identify the DASD of the defective storage array controller by the passive array controller

Hubis discloses:

a RAID system (see column 5 lines 1-5).

a table on each DASD used to identify the DASD of the defective storage array controller by the passive array controller (see column 18 lines 22-31).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have a RAID system. A person of ordinary skill in the art would have been motivated to make the modification because Nelson discloses a disk storage system and a RAID system constitutes a disk storage system. Furthermore, it would have been obvious for one of ordinary skill in the art at the time the invention was made to identifying the DASD of the defective storage array controller by the passive array controller using a table on each DASD. A person of ordinary skill in the art would have been motivated to make the modification because Nelson discloses assuming control of the DASD of the defective storage array controller and using a table on each DASD with Volume Mapping information, as per teachings of Hubis, enables assuming control of the DASD of the defective storage array controller by the passive storage array controller (see column 18 lines 22-31).

In regards to claim 12, Nelson discloses emitting a defective storage array controller signal by the passive storage controller (see column 9 lines 60-65).

Claims 13 and 14 are rejected for similar reasons stated in claim 11 and 12, respectively.

Allowable Subject Matter

Claims 9 and 10 are allowed for reasons stated in the previous office action.

Response to Arguments

Applicant's arguments filed December 15, 2003 have been fully considered but they are not deemed to be persuasive.

In regards to arguments for claims 1-8, applicant's amendment necessitated the new ground(s) of rejection presented in this Office action.

In response to arguments regarding claims 11-12 that cites "There is no passive controller in Nelson. Failure of one controller in Nelson of necessity means a decline in channel capacity or speeds of operation" (see page 9 middle paragraph under Remarks), and "The ability of the present invention to provide undiminished channel capacity or speed in the face of failure of an active controller provides an unexpected advantage to the present invention. There is no teaching in Nelson or Hubis to combine the teachings in these disclosures..." (see page 10 top paragraph under Remarks) examiner respectfully disagrees.

Nelson discloses a slave controller that does not respond to the host request (see column 9 lines 20-25), thus indicating passive controller. Furthermore, Nelson discloses the slave controller becomes master (active) controller when the master (active) controller fails to respond, thus indicating providing undiminished channel capacity. Examiner maintains his rejection.

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In response to argument regarding claims 11-12 that cites "Thus Nelson differs significantly from the present invention in which one passive controller serves to provide redundant capacity to as many as 20 active controllers..."(see page 9 middle paragraph under Remarks), no where in claims 11-12 does applicant claim such a limitation. Thus, argument is invalid. Examiner maintains his rejection.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Emerson C Puente whose telephone number is (703) 305-8012.


The examiner can normally be reached on 8-5 M-F.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert W Beausoliel can be reached on (703) 305-9713. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 306-5631.

Emerson Puente
2/27/04


ROBERT BEAUSOLIEL
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